King County's SciFYI
A digest of current natural science issues in King County
June 2009
King County
Department of Natural Resources and Parks
Water and Land Resources Division

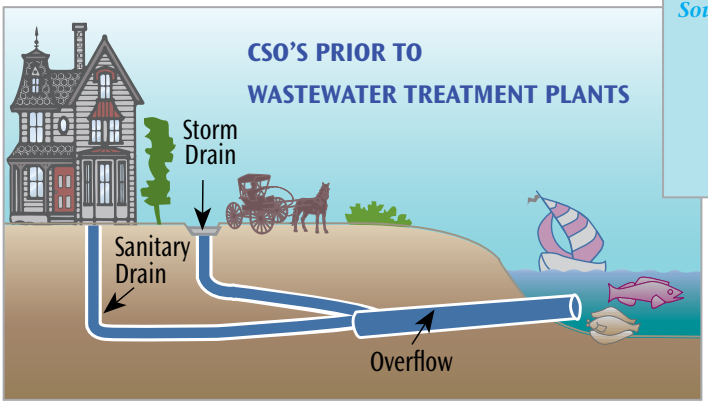
In Situ Water Quality Monitoring During the Denny Way CSO Sediment Remediation Project

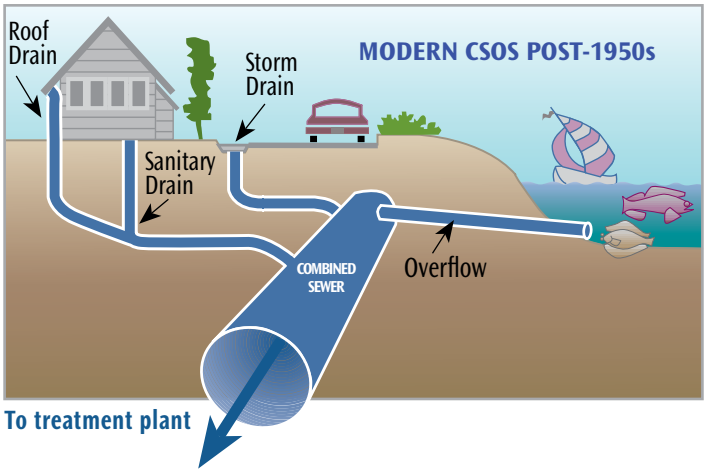
By Scott Mickelson, Senior Water Quality Project Manager

Introduction

CSO–or Combined Sewer Overflows–are discharges of untreated sewage and stormwater that are released directly into lakes, streams or marine waters during heavy rainfall when sewers have reached their capacity.

From the late 1800's, engineers designed combined sewers to carry sewage, garbage and horse manure from city streets combined with street and rooftop runoff from rainfall. This mixture was conveyed to the nearest receiving body of water. A CSO contains chemicals and disease-causing pathogens, and both CSOs and stormwater can be harmful to public health and aquatic environments.





Denny Way CSO

The Denny Way CSO was the largest in King County's wastewater treatment system, with frequent overflows during rain storms that exceeded system capacity. Overflows during lower tides would discharge directly onto the beach at Myrtle Edwards Park. The system was upgraded in 2005 and discharges were moved offshore. Legacy sediment contamination, however, required remediation in the nearshore area.

King County began sediment remediation in November 2007 through a combination of dredging and backfilling with clean material. Approximately 20,000 cubic yards of sediment, contaminated with PCBs, PAHs, phthalates, mercury, and silver, were dredged and transported for upland disposal. Clean backfill material was provided from routine maintenance dredging of the Duwamish River Turning Basin. After backfilling was complete, the area was armored using a coarse-grained material called habitat mix.

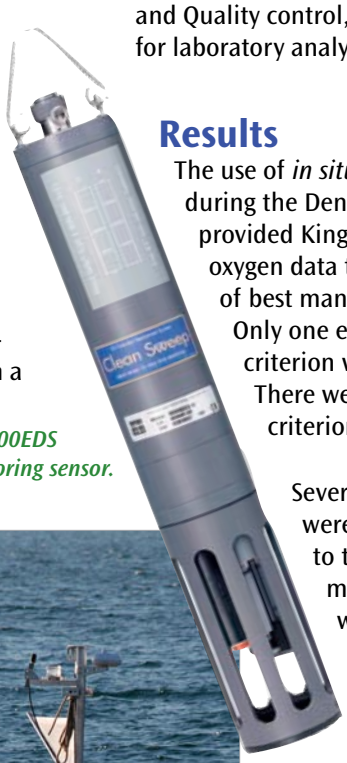
Washington State Department of Ecology regulations required monitoring turbidity and dissolved oxygen just outside of the construction mixing zone to determine whether construction activities were causing excursions beyond the applicable water quality criteria found in Chapter 173-201A of the Washington Administrative Code. King County opted to place an *in situ* ("in place") monitoring system at the site so water quality could be measured consistently and at a high frequency. This would allow county construction field staff to better supervise construction activities and institute best management practices if water quality was affected.

(Continued)

In Situ Water Quality Monitoring System

Electronic water quality monitoring sensors were mounted on a buoy at the construction site. High-frequency data were averaged every 15 minutes and uploaded through telemetry to a Web site. Since the water quality criteria for both turbidity and dissolved oxygen are relative to background, a reference station was established as a permanent sensor installation at the Seattle Aquarium.

The water quality monitoring system was comprised of YSI 6600EDS (Extended Deployment System). These instruments consist of a cylindrical pressure-resistant body with a cable connection on one end and temperature, conductivity, pressure, dissolved oxygen, turbidity and chlorophyll probes on the opposite end. An anti-fouling wiping system was used to prolong the calibration life and a "Rapid Pulse™" dissolved oxygen sensor removed the need for a stirring mechanism. This monitoring probe was deployed at the construction site on an offshore buoy and at the Seattle Aquarium in a permanent installation in the aquarium's pump house. The buoy, manufactured by Sound Ocean Systems, included an aluminum mast with sensor mounting plates, an autonomous mast light and radar reflector, and antifouling paint and rubber "rub-rails" at two heights.



YSI 6600EDS monitoring sensor.

Sensors deployed on a buoy at the sediment remediation construction site.

Although the *in situ* monitoring system was designed to operate relatively autonomously, there were still monthly field activities necessary to maintain the integrity of the data. These included: Monthly maintenance; Monthly calibration; and Quality control, which included collection of water samples for laboratory analysis of dissolved oxygen and turbidity.

Results

The use of *in situ* water quality monitoring instrumentation during the Denny Way CSO sediment remediation project provided King County with real-time turbidity and dissolved oxygen data that allowed instantaneous implementation of best management practices during dredging activities. Only one excursion above the turbidity water quality criterion was recorded during dredging activities. There were no excursions above the dissolved oxygen criterion.

Several excursions above the turbidity criterion were recorded during backfilling activities due to the amount of fine material in the "habitat mix" used as clean backfill. The real-time data was very useful in modifying the backfilling procedures.

Other benefits of the *in situ* water quality monitoring were: Acceptance of monitoring methodology by the Washington State Department Ecology; positive coverage in the local press; and inquiries for use of the instrumentation and buoy on other construction monitoring projects.

More information on CSOs can be found at: www.kingcounty.gov/environment/wastewater/CSO and http://cfpub.epa.gov/npdes/home.cfm.

Data collection–Data sharing–Looking for dialogue!

King County's Science and Technical Support Section is responsible for collecting, analyzing, modeling, and interpreting the information that informs land use, habitat management, sewage treatment, water resources, and surface water management decisions (see pages 3 and 4 regarding science section mission and services).

As part of the Section's new business plan, staff and management are interested in more effectively exchanging ideas, project findings and analytical techniques. There are many ways to share our data, interests, and viewpoints that can be mutually beneficial, and we would like to enhance our communications and explore these opportunities.

For example, aquatic macroinvertebrates are good indicators of stream quality and watershed health. Over the past two years, King County has worked with several jurisdictions, including Pierce and Snohomish counties and the City of Seattle, to develop a data management system dedicated to stream macroinvertebrate data. The system includes a managed data repository with a Web interface. Some features of the joint system are:

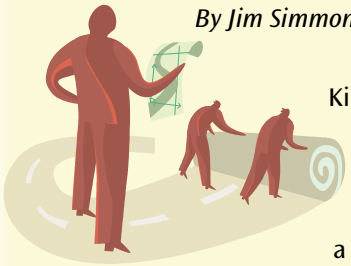
- Groups that collect data retain data ownership, with rights to edit or delete their existing data, along with the ability to add data via secured, Web-based, data stewardship controls.
- All entities that contribute data to the system agree to unlimited data sharing with other jurisdictions, state and federal agencies, tribes, public, etc.
- All data contributors will pay an annual maintenance fee.
- Data is displayed and downloadable via the Web, and housed in a SQL database.
- Web site key features: sampling site maps, downloadable raw data (taxonomic counts), standardized Integrated Taxonomic Information System codes for taxonomic identification, downloadable multiple metrics (e.g., tolerant species,) and more.
- System hardware is housed with a third party vendor.

Access the system at www.pugetsoundstreambenthos.org.

We are currently developing a contact list to begin a dialogue. If you would like to be included in these discussions and think that we may not have contact information, please call or email Tom Georgianna at tom.georgianna@kingcounty.gov, 206-263-6569.

The Importance of Environmental Monitoring and Analysis

By Jim Simmonds Supervisor King County Science and Technical Support section



King County has tested for water pollution and monitored environmental health for over 40 years. Having good data describing the quality of our local environment is important to the long-term sustainability of King County's natural resources.

Starting in the 1950s with concerns about sewage impacts on Lake Washington, there has been a high level of interest throughout the region in ensuring that our collective actions don't harm the environment to unacceptable levels. The data collected on Lake Washington water quality half a century ago spurred the creation of the regional wastewater system now owned and operated by King County.

Today, the recovery of Lake Washington following diversion of the sewage flows is studied in university classes worldwide as an example of how urban areas and natural environments can coexist.

It is comforting to know that the visionary actions of our predecessors eliminated the environmental harm caused by the daily discharge of millions of gallons of sewage into Lake Washington. However, King County's environment is now facing other threats and challenges related to population growth, urban sprawl, invasive species, climate change, stormwater runoff, and habitat destruction.

Routinely collected scientific data about environmental quality can help provide an early warning should any unacceptable environmental impacts loom in our future.

What is happening now?

The King County Science and Technical Support Section, in collaboration with the King County Environmental Laboratory, continue testing water quality in our region's lakes, streams, rivers, estuaries and Puget Sound. We also support collecting data necessary for implementing salmon recovery plans, and track the amount of water flowing in the county's many rivers and streams.

New initiatives we hope to implement in the coming years include:

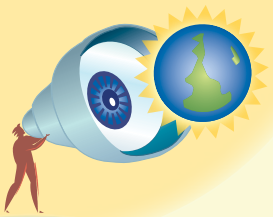
- Gathering data on the impacts of climate change on King County infrastructure and programs to allow for wise expenditure of funds and to allow adaptation to future changes at minimal cost;
- Gathering flow, habitat, and biology data necessary to design, permit, build, and assess the many levee and other construction projects called for in the King County Flood Hazard Management Plan;
- Gathering stormwater runoff quality data needed to ensure that future stormwater treatment approaches and technologies safeguard our water quality;
- Gathering biological and ecological data necessary to understand biodiversity within King County, and how it is changing over time; and to identify techniques and approaches needed to manage and protect multiple species and their habitats.

Quality of life is routinely rated as being of high importance by many residents in the Puget Sound region. Protecting our natural environment from unacceptable harm is an important component of maintaining our quality of life. The scientific testing done by the King County Science and Technical Support Section and the King County Environmental Laboratory is a key component in ensuring this protection lasts for future generations.

The Science Section Vision Statement

A vision statement focuses on the future by answering the question, "Where do you want to go?," and by defining the ultimate result of an organization's work. It should serve as an inspiration to those who work within an organization and provide the framework for strategic planning. The Section vision statement is:

"Healthy and sustainable ecosystems."



The Science Section Mission Statement

A mission statement focuses on the present and is a brief description of an organization's purpose. It answers the question, "Why do we exist?" and articulates the organization's purpose both for those internal and external to the organization. The Section's mission statement meets that definition and reads as follows:

"To provide scientific knowledge, information and analysis in support of regional environmental resource management."

Science and Technical Support Section Work Activities Overview

The Science and Technical Support Section provides the following services:

ENVIRONMENTAL MONITORING:

In cooperation with the King County Environmental Laboratory, the Science Section conducts the following types of environmental monitoring:

- Long-term monitoring of environmental conditions to determine status, changed conditions, and trends;
- Public health protection monitoring related swimming beaches, red tides, and sewage leaks and spills;
- Pre-construction, in-construction, and post-construction project monitoring and effectiveness monitoring;
- Regulatory monitoring for NPDES permit compliance;
- Impact monitoring to assess performance of wastewater treatment plants, CSO discharges, and storm water discharges; and
- Detailed site characterization studies to support toxic chemical remediation, the development of source control approaches, and the development of basin plans for storm water management.

PERMIT SUPPORT:

Staff in the Science Section routinely assists with project design and permit acquisition for various habitat restoration, flood control, and storm water management construction projects.

ENVIRONMENTAL ASSESSMENT SUPPORT:

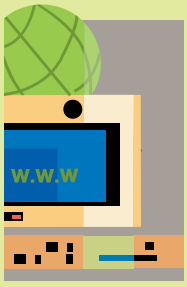
Using available data, the Science Section evaluates potential environmental impacts from plans and projects undergoing environmental review, and will help identify methods for avoiding or mitigating impacts.

POLICY DEVELOPMENT SUPPORT:

Science Section staff support programs and plans such as the Shoreline Master Plan, the Critical Areas Ordinance, and the King County Comprehensive Plan with up-to-date and applicable scientific information.

PUBLIC EDUCATION:

The Science Section provides public information and education via science seminars, publication of the science newsletter, presenting scientific findings at conferences, and providing science information via King County Web pages.



Eelgrass Restoration at the Brightwater Marine Outfall

By Kimberle Stark, Marine Biologist

Why Care About Eelgrass?

Eelgrass (*Zostera marina*) is a native perennial plant that forms underwater meadows (beds) in marine nearshore environments. Eelgrass provides nursery habitat for many commercially important fish and invertebrates as well as providing food and spawning substrate.

Background

The King County Wastewater Treatment Division's new Brightwater Wastewater Treatment Plant will discharge highly treated effluent through a marine outfall to Puget Sound. After a comprehensive siting process to find a suitable location for the outfall pipe and to minimize effects on the nearshore marine environment, the Point Wells site near the King/Snohomish county line was selected. Construction of the outfall began in late May of 2008. Open-trench construction was used through onshore and nearshore areas to a depth of -80 feet Mean Lower Low Water (MLLW). Trench shoring (sheeting) was used to a depth of -30 ft. MLLW to minimize impacts to eelgrass and other biological resources. Eelgrass is sparse at the outfall site, occurring from about -2 to -15 ft. MLLW.

To mitigate for unavoidable construction impacts to eelgrass areas, an innovative eelgrass restoration plan was developed in collaboration with state agencies in 2004.

About the Project

The project objective is to restore intertidal and shallow subtidal eelgrass habitat to preconstruction conditions. This will be accomplished by several elements including: Pre-construction surveys; Eelgrass harvesting and propagation prior to construction; Establishing experimental harvest plots to assess eelgrass recovery; Transplanting; and Post-construction surveys. Each element is described below:

Pre-construction surveys: The purpose of preconstruction surveys was to document the extent and density of eelgrass at the project and reference sites and to assess inter-annual variation. Five survey transects at the project site were established and a combination of side-scan sonar, underwater video, and SCUBA diver methods were used in 2004, 2006 and 2008.

Experimental harvest plots: In an effort to assist state agencies on the effects of removing a portion of eelgrass from a donor bed, experimental harvest plots were established at the outfall site in 2004. Five 2.0 m^2 rectangular plots were established in the area where all eelgrass would be lost during construction. The plots were divided into eight subplots and each subplot had a specific amount of eelgrass harvested—0 percent, 5 percent, 10 percent, 25 percent, 50 percent, and 100 percent. The harvest plots were monitored by SCUBA divers in 2005, 2006 and 2007.

Transplanting: In May 2009, a side-scan sonar and underwater video survey will be conducted to determine if eelgrass was disturbed outside of the outfall construction zone, which would require replanting. Following this survey, eelgrass in the tanks at Battelle will be transplanted back to the project site in all areas where eelgrass was disturbed. SCUBA divers will bundle the plants together and place them into the substrate. Transplanting occurred in late May 2009 during the active growing season to allow the plants time to reestablish prior to winter storms.

Post-construction surveys: Eelgrass surveys will be conducted following transplanting to document eelgrass recovery and assess recovery against both short-term and long-term project performance standards. The series of five survey transects will be reestablished and SCUBA divers will count the number of eelgrass plants in 2009, 2010, 2011 and 2014.

For a more detailed description of all the elements listed above, please read the *Eelgrass Restoration and Biological Resources Implementation Workplan* at http://green.kingcounty.gov/marine/reports/eelgrass-restoration-workplan.aspx. Project reports are also available on this Web site.

Consultant in scuba gear salvaging eelgrass.

Eelgrass Salvage Effort: *In an effort to avoid harvesting eelgrass from a donor site for transplanting after construction, a portion of existing eelgrass was harvested from the project site in 2004, 2006, 2007 and propagated offsite at Battelle Marine Sciences Laboratory. Most of the eelgrass that would have been lost during construction was salvaged in 2008 and planted into the Battelle tanks along with the other Brightwater eelgrass.*

Science Seminars

Science seminars provide a peer review process prior to public distribution of scientific findings and discoveries for WRIA (Water Resource Inventory Area) technical committees.

By Larry Jones
The Science and Technical Support Section sponsors semi-annual half day science seminars in which county staff and special guests present recent findings from their environmental monitoring programs.

The science seminars provide an opportunity for sharing information between staff, and with the public. Science seminars are open to all interested the vast array of environmental sciences.

The May 5th seminar featured topics that included:

- *PugetSoundStreamBenthos.org: An inter-agency resource for managing benthic macroinvertebrate monitoring data in the Puget Sound region*—Doug Henderson
- *Phosphorus legislation—Where the rubber meets the road*—Beth Cullen
- *An evaluation of restoration effectiveness on the Snoqualmie and Tolt rivers*—Josh Latterell
- *Asking the right questions and getting meaningful answers: A monitoring framework for Chinook salmon recovery in the Lake Washington/Cedar/Sammamish watershed*—Scott Stolnack

Some of the science topics discussed during the last few sessions included:

- *Mapping the Geology of the Greater Seattle Area: Infiltration, Peat Bogs, and Volcanic Ash*—Kathy Troost, UW
- *An overview of the geology and geomorphology of the Snoqualmie watershed*—John Bethel
- *Development of 3-D hydrodynamic and water quality models for Lake Sammamish*—Curtis Degasperi
- *Bioaccumulation of persistent bioaccumulative compounds in Lake Washington fishes*—Jen McIntyre, UW
- *A sediment triad evaluation for lakes Sammamish, Washington, and Union*—Kari Moshenberg
- *The relationship between limnological parameters and seasonal fish distribution and implications for trophic interactions in Lake Sammamish, Washington*—Hans Berge
- *Development of a fish index for King County lowland streams*—Deanna Matzen
- *Instrumentation and methods for collecting conductivity, temperature, and depth data*—Bob Kruger
- *Analysis of conductivity, temperature, and depth data in Puget Sound*—Angela Grout
- *Challenges and Effectiveness of I/I Reduction on Private Property and in Component Agency Systems for 10 Pilot Projects - King County, Wash.*—Erica Herrin, Zhong Ji, and Bruce Crawford
- *Biodiversity Planning in King County: The LAB Project*—Jennifer Vanderhoof and Bob Fuerstenberg
- *Cedar River Landslide: A Sockeye Response*—Ray Timm
- *Greater Lake Washington Human Health Risk Assessment*—Richard Jack
- *Preliminary Effects of Increased Flooding Due to Placement of Large Woody Debris*—Jeff Burkey
- *Stream Sediments Monitoring Program*—Dean Wilson

If you would like to attend the next seminar please RSVP with:
Jim Simmonds 206-296-1986 jim.simmonds@kingcounty.gov
Kate O'Laughlin 206-296-8363 kate.olaughlin@kingcounty.gov

For more information on the above presentations, we recommend that you visit the Science and Technical Support Section Seminar Web site:
http://green.kingcounty.gov/WLR/Science/Seminar/Seminars.aspx

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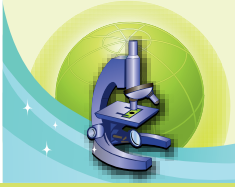
Send questions, comments and future story ideas to:
Kate O'Laughlin - kate.olaughlin@kingcounty.gov, 206-296-8363 or
Jim Simmonds - jim.simmonds@kingcounty.gov, 206-296-1986



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